Future climate change revealed by current climate variations

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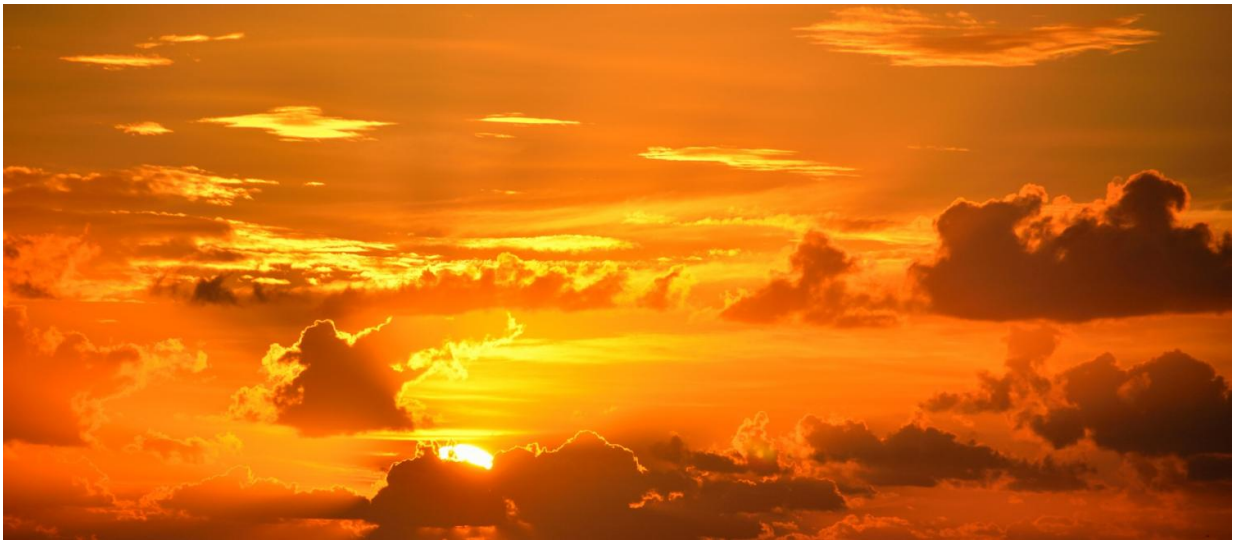

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Uncertainty surrounding the extent of future climate change could be dramatically reduced by studying year-on-year global temperature fluctuations, new research has shown.

A team of scientists from the University of Exeter and the Centre of Ecology and Hydrology has pioneered a new process to reduce uncertainty around climate sensitivity - the expected long-term global warming if atmospheric carbon dioxide is stabilised at double pre-industrial levels.

While the standard 'likely' range of climate sensitivity has remained at 1.5-4.5°C for the last 25 years the new study, published in leading scientific journal *Nature*, has reduced this range by around 60 per cent.

The research team believe that by dramatically reducing the range of climate sensitivity, scientists will be able to have a much more accurate picture of long-term changes to the Earth climate.

Lead-author Professor Peter Cox from the University of Exeter said: "You can think of global warming as the stretching of a spring as we hang weights from it, and climate sensitivity as related to the strength of the spring.

"To relate the observed global warming to climate sensitivity you need to know the amount of weight being added to the spring, which climate scientists call the 'forcing', and also how quickly the spring responds to added weight. Unfortunately, we know neither of these things very well".

The new research made their breakthrough by moving their focus away from global warming trends to date, and instead studying variations in yearly global temperatures.

Co-author Professor Chris Huntingford, from the Centre for Ecology and Hydrology, explained: "Much of climate science is about checking for general trends in data and comparing these to climate model outputs, but year-to-year variations can tell us a lot about longer-term changes we can expect in a physical system such as Earth's climate."

Mark Williamson, co-author of the study and a postdoctoral researcher at the University of Exeter, carried out the calculations to work-out a measure of temperature fluctuations that reveals climate sensitivity.

This metric of temperature fluctuations can also be estimated from

climate observations, allowing the model line and the observations to be combined to estimate climate sensitivity.

Using this approach, the team derive a range of climate sensitivity to doubling carbon dioxide of 2.8+/-0.6°C, which reduces the standard uncertainty in climate sensitivity (of 1.5-4.5°C) by around 60%.

Mark said: "We used the simplest model of how the global temperature varies, to derive an equation relating the timescale and size of the fluctuations in global temperature to the climate sensitivity. We were delighted to find that the most complex climate models fitted around that theoretical line".

Explaining the significance of the results, Professor Cox added: "Our study all but rules-out very low or very high climate sensitivities, so we now know much better what we need to. Climate sensitivity is high enough to demand action, but not so high that it is too late to avoid dangerous global climate change".

More information: Emergent constraint on equilibrium climate sensitivity from global temperature variability, *Nature* (2018). nature.com/articles/doi:10.1038/nature25450

Provided by University of Exeter